Warranty Reserve: Contingent Liability, Strategic Signal, or Earnings Management Tool?*

Daniel Cohen[a], Masako Darrough[b], Rong Huang[c], Tzachi Zach[d]

[a] *Stern School of Business, New York University*
, dcohen@stern.nyu.edu

[b] *Zicklin School of Business, Baruch College*
Masako_Darrough@baruch.cuny.edu

[c] *Zicklin School of Business, Baruch College*
Rong_Huang@baruch.cuny.edu

[d] *Olin School of Business, Washington University in St. Louis*
zach@wustl.edu

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Abstract

Utilizing a database that recently became available due to the requirements of FIN 45, we examine the information content of accounting disclosures on warranties from two perspectives. First, since a warranty policy is a business strategy through which firms choose to promote their products, a warranty reserve serves two roles: a signal of product quality as well as a contingent liability to be honored in the future. Consistent with this view, we find that the stock market recognizes the warranty reserve as both a signal of firms' future performance as well as a liability. Second, since warranty accruals require estimation of future claims, any discretion in this context can also be used as a tool of earnings management. Consistent with this expectation, our evidence indicates that managers use warranty accruals to manage earnings opportunistically to meet their earnings targets.

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1. Introduction

Most durable products are sold with warranties.[1] A warranty is a guarantee a manufacturer/vendor provides to its customers that the product purchased will provide expected service; in the event of failure, the warranty provider would rectify the product according to the terms of the warranty policy. The terms of a warranty policy can vary in its duration and scope (full or limited, labor and/or parts, repair vs. refund, etc.). When there is any uncertainty about the future performance of the product, a warranty is an effective remedy for reducing this uncertainty. For the manufacturer, who possesses better information about the expected performance of the product, a warranty is an effective means for credible communication. As such, the role of product warranties in resolving information asymmetry problems between buyers and sellers has been studied extensively in the economics (e.g., Spence, 1977, Grossman, 1981, and Lutz, 1989) and the marketing literature (e.g., Menezes and Quelch, 1990).

The accounting aspects of product warranties, however, have yet to be studied. In this paper, we fill this void in the literature by presenting an empirical analysis that investigates the role of warranty information. We use a unique and comprehensive database of warranty disclosures that had not been available to researchers until recently. Although firms were at liberty to disclose warranty information voluntarily, FIN 45, which took effect starting in 2003, mandated the disclosure of such information. We study a sample of 600 firms which disclosed quarterly warranty information from 2003 to 2006. Our research questions are twofold. First, how does the market interpret accounting information on warranties? Specifically, we examine whether the capital market interprets warranty

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[1] Most products are sold with either an express or implied warranty. An express warranty is typically specified by a written warranty policy that spells out the terms of warranty, while an implied warranty is an implicit understanding that the product being sold meets the warranty of merchantability, i.e., fit for sale and consumption as represented at the time of sale. An extended warranty may be offered by retailers for an additional premium.

reserves as a contingent liability, a strategic signal, or an earnings management tool. Second, how do managers make accrual choices with regard to the future obligations for product warranties?

Our first research question examines the market valuation of warranty reserves. Since a firm's warranty policy reflects its business strategies on product quality, reliability, and post-sale customer-care, the warranty reserve performs dual roles: one as a future obligation to perform warranty service work if a product fails (a contingent liability), and the other as a signal of the firm's product quality and reliability. Due to this dual nature of the warranty reserve, we would expect a warranty liability to be different from other monetary liabilities such as bank loans. Several studies have examined the relation between different types of liabilities and market prices, documenting in general a negative relation (e.g., Barth, 1991; Espahbodi et al. 1991; Landsman, 1986; Mittelstaedt and Warshawsky, 1993; Barth and McNichols, 1994). Our analysis demonstrates that the stock market values the warranty liability and other liabilities differently by placing a smaller negative valuation coefficient on the warranty liability. However, after controlling for analyst earnings growth expectations, the valuation coefficients on both the warranty liability and other liabilities approach negative one. This suggests that the market also interprets the warranty liability as a signal for future earnings growth prospects. Consistent with this conjecture, we demonstrate that firms with higher warranty reserves successfully attract more future sales, exhibit higher future profitability, and receive stronger positive market reactions around quarterly earnings announcements.

Our second research question investigates whether managers strategically choose warranty accruals as a method of credible communication, or alternatively, as an opportunistic method of earnings management. Although a warranty policy is formulated as part of an overall business model, managers might additionally use accounting discretion for warranties to signal their expectations regarding the future quality of the firm's products and its future performance. In the accounting literature, this type of managerial behavior, in which discretion is applied to reported earnings, has been viewed as a tool to improve the information value of accounting numbers (e.g., Watts and Zimmerman, 1986; Bernard and Skinner, 1996; Subramanyam, 1996, among others).

We find a significant positive relation between "abnormal" warranty expenses and future firm performance (as reflected in sales growth and return on assets). In addition, we document a positive stock market reaction to abnormal warranty expenses. Together, these findings suggest that the market incorporates the warranty information in a manner consistent with the signaling model. In turn, these findings also suggest that firms use warranty expenses as a signaling mechanism to convey their private information about future firm performance. Additionally, we find a negative relation between future firm performance and abnormal product warranty claims.

Managers might exercise discretion over the accounting treatment of warranties as a means of opportunistic earnings management. Under this scenario, managers gain private benefits (such as increases in compensation) from manipulating the reported accounting numbers, adding noise to the financial reporting process. These opportunistic accounting decisions can be achieved through changes in the assumptions and estimates underlying warranty accruals. In particular, we examine whether managers use warranty accruals in order to meet certain short-term financial reporting objectives. Achieving earnings targets, such as avoiding losses, avoiding earnings decreases and meeting or beating analysts' forecasts, has been extensively studied in the accounting literature (e.g., Burgstahler and Dichev, 1997; DeGeorge et al., 1999). In general, the consensus in prior research is that managers care greatly about these earnings benchmarks and are willing to engage in costly earnings management strategies to achieve them (e.g., Brown and Caylor, 2005; Graham et al., 2005). Specifically, the survey results provided by Graham et al. (2005) report that top executives admitted to such behavior. About 75 percent of respondents agreed that beating earnings benchmarks is important to them.

A recent example to illustrate this point is Dell Corporation. In December 2006, an analyst report accused Dell of managing its warranty reserves opportunistically and claimed that Dell "hadn't

been setting aside enough money to cover potential warranty costs, thereby inflating its earnings." Around the same time, Dell has been the target of an accounting probe by the SEC, which some have argued is related to Dell's warranty accounting policies.[2]

We find evidence consistent with managers using warranty accruals to achieve specific financial reporting objectives. In particular, abnormal warranty expenses are associated with two popularly cited earnings targets: (1) avoiding reporting a loss and (2) avoiding reporting an earnings decrease. We find that firms that have earnings slightly above certain earnings targets report significantly lower warranty expenses than their counterparts. Our evidence implies that managers use the flexibility in the assumptions underlying the calculation of warranty expenses and exercise their discretion to achieve these financial reporting targets.

Our final analysis, which combines the valuation and earnings management aspects, shows that, after controlling for managerial strategic choices and earnings management incentives, warranty liability converges to its expected market value. Consequently each $1 of warranty liability reduces the market value by $1.[3] We document that those "Suspect" firms, which are likely to have missed their earnings targets without under-accruing warranty expenses, have a stronger negative valuation coefficient on their warranty liabilities. This suggests that investors recognize that reported warranty liabilities are understated for these firms.

Our study is the first to exploit a unique and comprehensive database on warranty disclosures. As such, we are able to contribute to the existing accounting literature in several ways. First, we extend prior research on the role of accounting information by examining how the capital market evaluates warranty information, and whether managers use their discretion over accounting for warranties to signal future firm performance. Second, we document that warranty reserves play dual

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[2] Dell's Internal Accounting Probe Uncovers Evidence of Misconduct -- Annual Report Is Delayed, Restatements May Follow; Problems Aren't Specified, *Wall Street Journal, March 30, 2007*.

[3] This is assuming that liabilities are measured in present value. To the extent that the warranty liabilities are reported without discounting, the reduction would be less than one.

roles, one as a contingent liability and another as a signal of product quality and future earnings growth. Third, by focusing on a specific accounting choice, which allows us to increase the power of our analysis, we specifically answer the calls made by accounting researchers (for example, McNichols, 2003) for disaggregating empirical measures of accounting choices. Fourth, we advance the literature on opportunistic earnings management behavior by exploring whether managers use their accounting discretion over warranty accruals to attain specific financial reporting targets, which have been highlighted by prior studies. This allows us to shed light on specific methods that managers use to achieve these targets. Thus far, the evidence on these specific methods has been scarce.

The paper proceeds as follows. In section 2 we provide some background on the economic role and accounting treatment of warranties. In section 3 we develop our hypotheses and in section 4 we describe our research design. We report our results in section 5 and we conclude in section 6.

2. Background

2.1 The Economic Role of Warranties

In the U.S., issuing a warranty plan for consumer products has its roots in the automobile industry. Consumer complaints about automobile quality increased in the 1950's and intensified the pressure on Congress to act on behalf of consumers. In 1968, a report issued by the Federal Trade Commission recognized the need to improve the quality of automobiles, but went short of mandating warranty plans. Slowly, more manufacturers began issuing warranties for consumer products as a standard practice. Ambiguities in these contracts, however, presented enforcement problems and to achieve a uniform standard in warranty contracts, the Congress passed the Magnusson Moss Act in 1975. Although the Act did not mandate the issuing of warranties, it required that a warranty plan

offered to consumer products explicitly describe the scope of coverage, the time period of coverage, the means to obtain warranty services, and how various state laws on warranties are affected.[4]

Once warranties were made to be more reliable, they became an increasingly important strategic mechanism for manufactures/vendors. The prevailing view in economics on warranties is that they are a means to overcome information asymmetries regarding product quality between an informed manufacturer/vendor and an uninformed customer. By issuing a warranty plan that depends on an *ex post* verifiable outcome that is correlated with product quality, the manufacturer bonds herself (and the buyer protects himself) to its product quality (Grossman, 1981). Spence (1977) posits that manufacturers provide warranties with better terms to signal the quality of their products. Boulding and Kirmani (1993) confirm in an experiment that consumers learn about product quality through the warranties offered. In addition, warranties are also used as a marketing tool to promote products (Menezes and Quelch, 1990). Heal (1977) shows that even when there is no information asymmetry regarding product quality between sellers and buyers, warranties can serve as a mechanism of risk sharing.

In a simple signaling model proposed by Spence (1977), firms use warranty plans as a signal of product quality. In a separating equilibrium (if it exists), a positive relation between the quality of products and the quality of warranty plans prevails. Although, this relation is intuitively appealing, it is by no means the only theoretical proposition in the economics literature. For example, even if there exists a separating equilibrium, this monotone relation between warranty coverage and quality can be reversed in more complicated settings. When a consumer buys a product with a warranty, he might not handle the product with proper care. Allowing moral hazard on the part of consumers, Lutz (1989) shows that a separating equilibrium exists in which high product quality is signaled with a low

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[4] To promote clarity of warranty coverage and consumer understanding of written warranties, the Act required that a warranty plan present information in "simple and readily understood language." Wisdom (1979) finds that written warranty policies did not become simpler, but disclosures became more extensive.

warranty plan and a low product price. When both consumers and producers are subject to moral hazard (double moral hazard), the quality/warranty coverage relation can be either positive or negative, depending on the parameter values (Cooper and Ross, 1985). Gal-Or (1989) analyzes the role of warranty in an oligopolistic market and shows that multiple equilibria can result; warranty/quality relation is positive in one, but negative in another equilibrium. In such a case, the informational content of a warranty plan is extremely limited. Given the contradicting predictions proposed by these models, the warranty/quality relation that might exist in the product market is, to a large extent, an empirical issue. As our benchmark, however, we focus on the separating equilibrium proposed by Spence.

2.2 Accounting for Warranties

Manufacturers who provide product warranties to their customers are required to record an accrued warranty expense at the time of sale.[5] Like many other accruals, these accrued warranty expenses are estimated based on company's projections of future claims. Such warranty expenses are an important component of firms' selling expenses and can be substantial in magnitude. In our sample, the average warranty expense constitutes about one percent of sales and about eleven percent of operating income.

The disclosures of warranty expenses and liabilities were voluntary until the issuance of Financial Interpretation No. 45 - *Guarantor's Accounting and Disclosure Requirement for Guarantees, Including Indirect Guarantees of Indebtedness of Others* (FIN 45) in 2002 (see FASB, 2002).[6] Prior to FIN 45, Gu (1998) finds that firms differ in their disclosure behavior with respect to warranty information. Thus, by mandating disclosures, FIN 45 expands the information made

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[5] Under the current accounting regulation (Technical Bulletin 90-1), revenues from extended warranties are deferred and service costs are expensed as incurred. Thus, accounting information on warranties does not include information on extended warranties.

[6] The requirements of FIN 45 appliy to financial reports ending after December 15, 2002.

available to investors about firms' warranty accruals, claims, and liabilities. Starting in 2003, firms provide: (1) the estimated potential amount of future payments under the warranty plan, (2) the accounting policy and methodology used in determining the liability for product warranties, and (3) a tabular reconciliation of the changes in the warranty liability for the reporting period. This detailed reconciliation presents the beginning balance of the aggregate product warranty liability, the aggregate reductions in that liability for payments made under the warranty plan, the aggregate changes in the liability for accruals related to product warranties issued during the reporting period, the aggregate changes in the liability for accruals related to preexisting warranties (including adjustments related to changes in estimates), and the ending balance of the aggregate product warranty liability. Appendix A provides two examples of warranty disclosures from the financial statements of Middelby Corp and 3M.

2.3 Interpretation of Warranty Data: A Signaling Perspective

We now discuss briefly how one could interpret the accounting information on warranty plans from the signaling perspective assuming that the primary purpose of warranty plans is to signal the product quality to the market. We assume that a unique fully separating equilibrium prevails in which better quality sellers provide better warranty coverage. We further assume that a warranty plan can be characterized by its duration (warranty period) and scope of coverage.[7] In the discussion below, we describe scenarios in which product quality and accounting variables, both warranty expenses and warranty liabilities, are positively related. Given the complexity of the product markets,

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[7] Even though scope entails different features (full or limited replacement, parts and labor, money back guarantee, etc), we assume that buyers are able to assign a strict preference ordering over (and possibly monetary values to) these various features. Therefore, a warranty plan with a longer warranty period and a more extensive scope of coverage is better than one with a shorter period and less scope. Since duration and scope may be regarded as substitutes, we further assume that buyers are able to assign values to all possible combinations.

other relations and interpretation are quite possible. Thus, how the market interprets the accounting information on warranties is ultimately an empirical question.

A separating equilibrium requires a cost structure in which the marginal cost of providing a better warranty plan is lower for firms with better product quality than for firms with poorer product quality (referred to as the single crossing property). A buyer can infer the quality of products sold by various sellers by observing their warranty plans. However, a better warranty plan for a better product need not cost more than a slightly inferior plan offered by a slightly inferior firm. Thus, we cannot conclude unambiguously that better firms would have higher warranty expenses. On the other hand, a firm without a warranty plan would have zero warranty expenses.[8] Therefore, under a certain cost structure, we expect better warranty plans to be more expensive. Better firms would incur more warranty costs, but higher prices or sales should result in higher profits. In such a case, warranty expenses and product quality are positively related. Another possible scenario is that for multiproduct firms, not all warranty plans are easily observable to the market. In that case, warranty expenses may be used as a signal combined with imperfect information on warranty plans.

Warranty liabilities are determined by warranty expenses and the claims processed during the coverage period. Assume that warranty expenses increase with the quality of warranty plans (cross sectionally) in a signaling equilibrium. Then, ceteris paribus, warranty reserves would be larger for warranty plans with longer duration. For simplicity, assume a product fails (if it fails at all) only on the last day of the warranty coverage period. If a warranty period is very short, say a week, then the maximum warranty liability that a firm would have is based on the sales during the last week, while if a warranty period is one year, the maximum warranty liability would be based on the sales

[8] It is unlikely that a firm with an extensive warranty plan would accrue zero warranty expenses by claiming that their products never fail.

during the last one-year period.[9] To the extent that a better warranty plan offers a longer warranty period, firms with a better quality product would have larger warranty liabilities. Similarly, if a firm has a warranty plan with better scope of coverage, the warranty cost per unit would be higher. Thus, the maximum warranty liabilities are again higher for better quality firms. Of course, claims are made and processed continuously. Consider an extreme case: assume that products fail continuously, say uniformly during the warranty period, and claims are submitted and processed instantaneously. Then the outstanding warranty liabilities would be one half of the sales made during the warranty period (i.e., one half of one week sales or one half of a one-year sales in the example above). Therefore, as before, the relation between product quality and warranty reserves is positive.

A warranty plan may also reflect a firm's strategy to improve its reputation among its customers. Ceteris paribus, customers can infer that a company providing products with better warranty coverage is a more reliable one than a company providing less of warranty coverage (Murthy and Djamaludin, 2002). Therefore, companies with better warranty coverage develop a reputation among customers that they support and believe in their products. Finally, firms may use warranties to strategically promote future sales and growth even though it is costly to do so. The marketing literature suggests that firms offer a warranty plan over a longer duration and/or more comprehensive coverage as an effective marketing tool (Menezes and Quelch, 1990). Since all these strategies are costly to implement, we expect, on average, that better firms are more likely and able to pursue them and separate themselves in a convincing manner from other firms.

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[9] Thus the claims are made at the end of the warranty period. We further assume that the claims are processed immediately, i.e., there is no outstanding warranty claims to be processed from previous periods.

3. Hypothesis Development

We now develop specific hypotheses for our empirical analysis. The first set of hypotheses focuses on warranties as part of an overall business strategy (as opposed to accounting choices). Firms make choices regarding their warranty policy (duration and scope of coverage) as part of their overall business model. Thus, this set of hypotheses addresses how the capital market evaluates accounting information on warranties, i.e., the warranty reserve and warranty accruals. The second set of hypotheses relates to the accounting choices regarding warranties. To the extent that firms have discretion over warranty accounting, we examine if they use it as a means of communicating information truthfully and credibly or alternatively as a means of opportunistic earnings management for private gains.

3.1 Valuation of the Warranty Liability

A product warranty is "an obligation incurred in connection with the sale of goods or services that may require further performance by the seller after the sale has taken place" (SFAS No. 5, Accounting for Contingencies). Because of the uncertainty involved with future claims, a product warranty falls under the definition of a contingent liability. FASB requires the recognition and disclosure of a warranty liability when it is probable that a liability has incurred and the amount of loss can be reasonably estimated. If investors view the warranty liability as being correctly estimated, they would place equal weights on the warranty liability and on other liabilities. In this case, the stock market values the entire amount of the warranty liability as reflecting the future cash flows to be paid out.

Valuation of any contingent liability is a complex issue as it involves assumptions and estimates that are unobservable by outsiders. Several studies have investigated the valuation implications of various contingent liabilities such as pensions (e.g., Barth, 1991; Espahbodi et al. 1991 and Landsman, 1986, among others), retirees' health benefits (Mittelstaedt and Warshawsky, 1993), bank loan loss provisions (Petroni 1992; Wahlen 1994; Liu et al. 1997), and environmental

liabilities (Barth and McNichols, 1994). In general, these studies find that the estimates of various contingent liabilities are negatively associated with share prices.

At the same time, the warranty reserve serves as an informational signal about a firm's business strategies, such as product quality, reliability, developing reputation, and marketing. As discussed in section 2.3, under a reasonable scenario, we expect firms with better quality products to incur larger warranty expenses and have larger warranty liabilities. Firms may try to mimic each other by offering identical warranty plans. However, such a pooling equilibrium would not be sustainable. Since buyers will be able to infer the quality of the products by examining warranty expenses (i.e., the higher warranty expenses, the lower the product quality), a lower quality firm is likely to reduce the level of warranty plans. Thus, in the long run, better firms are more likely to offer better plans.[10]

Thus, we conjecture that the stock market will consider the signaling value of warranty liabilities and differentiate between warranty liabilities and other liabilities (e.g., bank loans) by recognizing the dual nature of warranty liabilities. In particular, the valuation coefficient placed on warranty liability is expected to be less negative than that on other liabilities recognized on the balance sheet. This is because, on the one hand, the stock market infers that the warranty reserve is an obligation to provide warranty services in the future, but, on the other hand, the stock market recognizes that a warranty is a firm-value-enhancing tool. Therefore our first hypothesis, stated in alternative form, is as follows:

H1: The valuation coefficient placed on warranty liability is less negative than the valuation coefficient placed on other recognized liabilities.

To investigate whether the stock market correctly values the true underlying "liability" role of warranty reserves, we examine the valuation of warranty reserves after controlling for their signaling

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[10] However, there are reasons why this scenario does not hold in some markets as discussed in the economics literature.

role. Since higher quality products lead to faster future earnings growth, we can separate the two roles by introducing explicitly the earnings growth expectations of the firm. Under this scenario, warranty reserves serving as a contingent liability are expected to be valued similarly as other liabilities. Furthermore, we expect that the warranty liability reduces share prices dollar-for-dollar once we control for growth expectations. Thus, our second set of hypotheses, stated in null form, is as follows:

H2: After controlling for earnings growth expectations, the valuation coefficient placed on warranty liability is equal to the valuation coefficient placed on other liabilities.

H2a: After controlling for earnings growth expectations, the valuation coefficient placed on warranty liability is equal to negative one.

3.2 Managerial Discretion over Accounting for Warranties

Next, we examine whether the changes in warranty accounting information provides any incremental signal about future firm performance. From the perspective of a firm, estimation of warranty liabilities require modeling the failure rates and the costs of rectification actions over the warranty period (Murthy and Djamaludin 2002). That is, accruals related to warranty expenses should reflect the estimates of the inherent quality of the products, given the warranty policy.

Unexpected changes in warranty expenses (referred to abnormal warranty expenses) may be a consequence of managers applying discretion to warranty accruals. Since accrual expense manipulation changes the resulting reported earnings, we refer to warranty accrual discretion as earnings management. We consider two types of incentives for earnings management: (1) intertemporal and (2) short-term (discussed in the next sub-section)

The incentives for intertemporal earnings management can be twofold: a desire to signal a better future firm prospect; or a desire to smooth income over time. If managers' private information indicates improvement in future firm performance (e.g., a higher demand for the products), they may choose to take a costly charge to current reported earnings by over-accruing warranty expenses. This might be accompanied by extensions of warranty plans as a sign of confidence in expected product quality and reliability and future firm performance. On the other hand, if managers' private

information indicates deteriorating future firm performance, they may choose to decrease warranty coverage, resulting in lower warranty expenses in the current period. Ceteris paribus, this managerial incentive predicts a *positive* relation between current "abnormal" warranty expenses (to be defined later) and future firm performance. One can view this behavior as "informative" discretion applied to reported earnings, in that it improves how current earnings are related to future firm performance (e.g., Watts and Zimmerman, 1986; Bernard and Skinner, 1996; Subramanyam, 1996).

Alternatively, managers might use warranty accruals as a tool for smoothing reported income over time. When future prospects are expected to be poor, managers can over-accrue warranty expenses in the current period, creating "cookie jar" reserves. The reserves are used to offset the future poor performance, by shifting income from the present period to the future. On the other hand, if managers expect better future prospects, then smoothing calls for under-accruing of warranties in the current period and shifting income from the future to the present. Thus, the smoothing behavior predicts a *negative* relation between current abnormal warranty expenses and future firm performance, regardless of whether the expected future performance is good or bad. The incentives for intertemporal earnings management is formally stated in the third set of hypotheses. The association between future performance and current abnormal warranty expenses is expected to be positive under the informational (signaling) hypothesis, while it is expected to be negative under the smoothing hypothesis.

H3a: Future sales growth is positively (negatively) associated with abnormal warranty expense.

H3b: Future earnings growth is positively (negatively) associated with abnormal warranty expense.

To the extent that the stock market can observe warranty expenses when financial statements are disclosed (or infer information about them through other means of communications, such as conference calls) we expect the stock price to react to unexpected or abnormal warranty expenses.

H3c: The stock market reacts positively (negatively) to abnormal warranty expense around quarterly earnings announcements.

We use future sales growth and future earnings growth to proxy for managers' private information about future firm performance. It is important to note that our above predictions rely on the assumption that managers possess private information about future firm performance at the time of exercising their discretion over warranty accruals. However, it is possible that managers are agnostic about their future performance and/or have no incentives to communicate their private information. In this case, we do not expect to observe any significant relation between current accrual choices and future firm performance.

In summary, if managers use warranty expenses as a signaling mechanism, the relation between abnormal warranty expenses and future firm performance is expected to be positive. However, if managers are attempting to smooth reported earnings over several periods based on their private information about the future, the relation between abnormal warranty expenses and future firm performance is expected to be negative.

3.3 Benchmark Beating and Warranty Accruals

We now examine the relation between accounting choices over warranty accruals and short-term managerial incentives to meet or beat certain earnings benchmarks. The means by which managers achieve the accounting objectives of meeting earnings targets are numerous, and could be generally classified into either accrual-based strategies or real earnings manipulations.[11] Despite this somewhat broad classification, the specific ways in which managers meet earnings targets have been quite elusive to accounting researchers. For example, Burgstahler and Dichev (1997) do not find strong evidence that a particular accounting manipulation is responsible for benchmark beating. Dechow et al. (2003) find no evidence that aggregate discretionary accrual measures are associated with

[11] Another way to achieve one of the important benchmarks advanced in the literature, namely meeting or beating analysts' forecasts, is by managing analysts' expectations (Mastumoto, 2002).

benchmark beating; they find no difference in the levels of abnormal accruals between small-profit firms and small-loss firms.[12]

In contrast to the aggregate accrual evidence, several studies examine specific accrual choices managers make and find some evidence of earnings management. By limiting attention to a specific accounting choice, these studies are able to potentially increase the power of the tests.[13] McNichols (2003) emphasizes the importance of disaggregating empirical measures of accounting choices to generate a more powerful empirical setting for the analysis. The warranty context enables us to overcome some of the difficulties posed by aggregate accrual-based measures and directly addresses the call for more research on this important attribute of the accrual accounting system.

We hypothesize that if firms use warranty expenses to achieve certain financial reporting objectives, there will be an association between abnormal warranty expenses and variables proxying for reporting incentives. We focus on three popular earnings benchmarks that were studied extensively in the accounting literature to date: (1) avoiding reporting a loss, (2) avoiding reporting an earnings decrease and (3) meeting analysts' forecasts. The evidence in the literature regarding these benchmarks suggests that managers view meeting or beating them as very important. In particular, based on their survey, Graham et al., (2005) conclude that:

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[12] Based on this evidence, they conclude that the kink in the reported earnings distribution is not solely attributed to earnings management. They acknowledge that one shortcoming to finding evidence of earnings management is the lack of statistical power in abnormal accrual models to differentiate earnings management at a fine level across the two groups of firms.

[13] For example, Beaver, McNichols and Nelson (2003) study the loan loss reserves in property-casualty insurance companies. They find that reserves are more understated in small profit firms than in small loss firms. This evidence is consistent with firms managing the loan loss reserve to avoid losses. Further, they find evidence that the loss reserve is managed throughout the earnings distribution but is managed mostly by small profit firms (income increasing) and by firms with the largest profits (income decreasing). Beatty et al. (2002) provide evidence that public banks reduce loan loss reserves to avoid reporting earnings declines. In addition, they show that the higher frequency of earnings increases, relative to earnings declines, is more prevalent in public banks than in private banks. They attribute this to the fact that public banks are more sensitive to beating earnings benchmarks because their investors are more likely to use heuristics in judging banks' performance. See also Moehrle (2002) and Dhaliwal, Gleason and Mills (2004).

> *"…CFOs believe that earnings, not cash flows, are the key metric considered by outsiders. The two most important earnings benchmarks are quarterly earnings for the same quarter last year and the analyst consensus estimate. Meeting or exceeding benchmarks is very important." (p. 5)*

They also write:

> *"Several performance benchmarks have been proposed in the literature…such as previous years' or seasonally lagged quarterly earnings, loss avoidance, or analysts' consensus estimates. The survey evidence … indicates that all four metrics are important: (i) same quarter last year (85.1% agree or strongly agree that this metric is important); (ii) analyst consensus estimate (73.5%); (iii) reporting a profit (65.2%); and (iv) previous quarter EPS (54.2%)."*

According to Brown and Caylor (2005), analysts' forecasts have become the most important benchmark to beat since the mid-1990s. This evidence is consistent with a long list of archival studies that find a tendency of firms to report earnings patterns consistent with incentives to meet or beat benchmarks.

To investigate the behavior of managers of a large set of manufacturing firms, we examine whether they appear to have managed warranty accruals to meet the three alternative benchmarks. For each of the three benchmarks, we define "suspect" firms as those firms that ex-post exceeded a particular benchmark, and fall to the immediate right of zero in the cross-sectional distribution of that benchmark. We conjecture that these firms may have achieved that goal through the management of warranty expenses. Thus, we compare abnormal warranty expenses of these firms to those of a set of non-suspect firms. Our hypothesis, in alternative form, can be summarized as follows:

H4: Firms that just exceeded an earnings benchmark (i.e. whose earnings, change in earnings or forecast error fall to the immediate right of zero in the cross-sectional distribution of the relevant benchmark) will report lower abnormal warranty expenses for that quarter compared to other firms.

3.4 Valuation of the Warranty Liability Combining Growth Expectations and Earnings Management Incentives

As we noted earlier, the stock market valuation of warranty reserves reflects three aspects: (i) a contingent liability representing future warranty claims to; (ii) managers' signaling of private

information about the firm's product quality and future performance; and (iii) an earnings management component that relates to managers' incentives to meet or beat earnings benchmarks. In section 3.1, we hypothesized (*H1*) that the reported warranty reserve as a whole, is valued less negatively than other liabilities. We then hypothesize (*H2 and H2a*) that after controlling for the signaling aspect (earnings growth expectations), the warranty liability is valued the same as other liabilities. We now incorporate earnings management incentives into our valuation framework.

Firms with strong incentives to meet or beat earnings benchmarks may engage in upward earnings management by opportunistically cutting down warranty expenses. This leads to an under-accrual of the warranty liability. If investors correctly infer that the warranty liability is understated by some firms, the stock market will adjust the underestimated warranty liability by placing a larger negative coefficient on the warranty liability of these firms. Therefore, we expect a more negative coefficient on the warranty liability for firms with strong incentives to meet or beat earnings benchmarks. Our hypothesis, stated in alternative form, is as follows:

H5: For firms that just exceeded an earnings benchmark, the valuation coefficient placed on the warranty liability is more negative than the valuation coefficient placed on other liabilities.

Finally, we expect that after controlling for earnings management incentives and growth expectations, the market values the warranty liability the same as other liabilities. The valuation coefficients on both the warranty liability and other liabilities would be close to negative one. Thus, we state our hypotheses in null forms as follows:

H6: After controlling for earnings growth expectations and earnings management incentives, the valuation coefficient placed on the warranty liability is the same as the valuation coefficient placed on other liabilities.

H6a: After controlling for growth expectations and earnings management incentives, the valuation coefficient placed on the warranty liability is equal to negative one.

4. Research Design: Proxies for abnormal warranty expenses and claims

In our analyses we use two proxies for quarterly abnormal warranty expenses and quarterly abnormal warranty claims. Our first proxy is based on the seasonal change in warranty expenses or

claims, adjusted for the seasonal change in sales. In calculating this proxy we assume that the level of warranty expenses (or claims) is proportional to sales, i.e., $WEXP_t = \alpha_t SALES_t$, where $\alpha_t = \frac{WEXP_{j,t-4}}{SALES_{j,t-4}}$. Thus, abnormal warranty expenses in our time-series seasonal model (*ABWEXP)* are:

$$\text{(Time-series model)} \qquad ABWEXP\_TIME_{j,t} = \frac{WEXP_{j,t} - WEXP_{j,t-4} * \frac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$$

We obtain quarterly observations of each variable (*t*) and use as a benchmark the same variables in the same quarter in the previous year (*t-4*). Marquardt and Weidman (2004) utilize a similar model in a different context. In this model we control for growth in a firm's operations, which is one of the important determinants of warranty accruals.

In a similar way, we compute the abnormal (or unexpected) claims made during a particular period as:

$$\text{(Time-series model)} \qquad ABCLAIM\_TIME_{j,t} = \frac{CLAIM_{j,t} - CLAIM_{j,t-4} * \frac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$$

This will be a more direct measure of changes in product quality.

Our second proxy is an industry-adjusted measure based on membership in a common two-digit SIC code group. For each quarter, we compute the mean level of the ratio of expenses (or claims) to sales, excluding the firm for which we calculate the measure. We consider the deviation from the industry mean as our proxy for the industry-adjusted abnormal warranty expenses (or claims). Thus, abnormal warranty expense in our industry model is:

$$\text{(Industry model)} \qquad ABWEXP\_INDUSTRY_{j,t} = \frac{WEXP_{j,t}}{SALES_{j,t}} - AVERAGE\left(\frac{WEXP_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$$

Similarly, abnormal claims are defined as:

(Industry model) $$ABCLAIM\_INDUSTRY_{j,t} = \frac{CLAIM_{j,t}}{SALES_{j,t}} - AVERAGE\left(\frac{CLAIM_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$$

5. Empirical Results

5.1 Data and Sample

The introduction of FIN 45 prompted a series of new disclosure requirements regarding the warranty accruals, actual warranty claims, and the amount of total liabilities associated with firms' warranties. We obtain these data, which were collected by Warranty Week, for the years 2003-2006.[14] The sample firms are drawn from the set of manufacturing firms that are expected to have significant warranty expenses.

Our sample construction procedure is described in Table 1. The original file contains 14,510 firm-quarter observations covering 889 unique firms. Of these, we eliminate 516 observations belonging to 26 firms for which we could not obtain valid *Compustat* identification information. We further delete 4,473 observations for which warranty expenses and claims are missing. Finally, we lose 3,278 observations because no valid abnormal warranty expense could be calculated for them. Our final sample, for most of our analyses, covers 4,521 firm-quarters spanning 600 firms.

The sample firms originate from several different industries, but as manufacturing firms, they concentrate in a number of groups. As reported in Table 2, about 70 percent of firms belong to three industry groups: manufacturers of industrial machinery and equipment (150 firms, 25 percent of sample firms), manufacturers of electronic and other electric equipment (146 firms, 24.3% of sample firms), and manufacturers of instruments (130 firms, 21.7% of sample firms).

In Table 3, we provide summary statistics that describe our sample firms. We measure all variables on a quarterly basis by taking averages from the first quarter of 2003 to the fourth quarter of

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[14] We thank Eric Arnum of Warranty Week for his help (www.warrantyweek.com).

2006. For some of the variables, we also provide, for comparison purposes, their values for firms in the S&P 500 index. Our sample firms are dispersed in size, and the average firm is of medium size. The average (median) market capitalization of our sample firms is $3.2 billion ($678 million), although there is large variation, with an inter-quartile range of $208 million in Q1 to $2.2 billion in Q3. The average quarterly sales of firms in our sample is $639 million. The average (median) book-to-market ratio is 0.47 (0.42) compared to 0.42 (0.38) of the S&P 500 firms, indicating that our sample firms exhibit similar growth as the index firms. Our sample firms' quarterly ROA is, on average, 0.8%. ROA before warranty expense is on average 1.2%. This is comparable to 1.5% ROA for S&P 500 firms.

Turning to information about warranty expenses, the average (median) warranty expense is $8.54 ($1.16) million. It comprises about 1.4% of sales and 1.5% of total expenses. However, the average (median) ratio of warranty expenses to the absolute value of net income is 54.8% (13.1%), indicating that for many of our sample firms, the effect of managing warranty expenses could be economically significant. Finally, we find that the liability for future warranty services comprises, on average, about 4.1% of sample firms' total liabilities.

Table 3 shows that abnormal warranty expenses comprise about 0.016% of total assets (median is 0.005%). The industry-adjusted warranty expense is 0.088% of total assets (median is 0.394% of total assets). The average deviation of warranty expenses from its benchmarks is small, which is not surprising since, absent of product quality changes or additional factors, warranty expenses are expected to stay around the benchmark level. This also suggests that our benchmark models are reasonable. The average (median) quarterly warranty claims is $7.35 million ($1.15 million). These claims constitute about 1.3% of current sales. Similarly, the abnormal claims center around zero, indicating that our benchmarks are reasonable proxies of expected expenses.

5.2 Stock Market Valuation of the Warranty Liability

We first investigate whether the accrued liabilities for warranties are related to firm's equity market prices. To do so, we estimate several models that include a firm's market price as the dependent variable, and various components of balance sheet items as well as net income as explanatory variables. We use shares outstanding as the deflator. Our empirical specifications are derived from the Ohlson (1995) model. They are consistent with prior research on valuation of pension liabilities (Landsman, 1986; Barth, 1991; Barth et al., 1992), liabilities on retirees' health benefits (Mittelstaedt and Warshawsky, 1993), and environmental liabilities (Barth and McNichols, 1994). Specifically, we estimate the following four models for firm *i* in time *t*:

$$P_{i,t} = \alpha_0 + \beta_1 BV_{i.t} + \beta_2 NI_{i,t} + \beta_3 NI_{i,t} * Q_1 + \beta_4 NI_{i,t} * Q_2 + \beta_5 NI_{i,t} * Q_3 + \varepsilon_{i,t} \quad (1)$$

$$P_{i,t} = \alpha_0 + \beta_{10} ASSET_{i.t} + \beta_{11} LIAB_{i.t} + \beta_2 NI_{i,t} + \beta_3 NI_{i,t} * Q_1 + \beta_4 NI_{i,t} * Q_2 + \beta_5 NI_{i,t} * Q_3 + \varepsilon_{i,t} \quad (2)$$

$$P_{i,t} = \alpha_0 + \beta_{10} ASSET_{i.t} + \beta_{12} WLIAB_{i.t} + \beta_{13} OTHER\_LIAB_{i.t} + \beta_2 NI_{i,t} + \beta_3 NI_{i,t} * Q_1 + \beta_4 NI_{i,t} * Q_2 + \beta_5 NI_{i,t} * Q_3 + \varepsilon_{i,t} \quad (3)$$

$$P_{i,t} = \alpha_0 + \beta_{10} ASSET_{i.t} + \beta_{12} WLIAB_{i.t} + \beta_{13} OTHER\_LIAB_{i.t} + \beta_{14} ANALYST\_GROWTH_{i.t} + \beta_2 NI_{i,t} + \beta_3 NI_{i,t} * Q_1 + \beta_4 NI_{i,t} * Q_2 + \beta_5 NI_{i,t} * Q_3 + \varepsilon_{i,t} \quad (4)$$

where $P_{i,t}$ is stock price, $BV_{i,t}$ is book value per share, $NI_{i,t}$ is earnings before extra-ordinary items per share, $ASSET_{i,t}$ is total assets per share, $LIAB_{i,t}$ is total liabilities per share, $WLIAB_{i,t}$ is the warranty liability per share, $OTHER\_LIAB_{i,t}$ is total liabilities excluding the warranty liability per share, and $ANALYST\_GROWTH_{i,t}$ is analyst long-term earnings growth forecasts as reported in IBES. To control for earnings seasonality, we include Q_1, Q_2 and Q_3 as indicators for the first three fiscal quarters.

Table 4 reports results of the market valuation of the warranty liability.[15] The first two models serve as benchmarks to compare with the subsequent regressions that incorporate warranty liabilities and growth expectations. Consistent with prior studies, the coefficient on book value per share in the first model is slightly above one (1.173) and the coefficient on earnings per share is positive and significant (15.228 in Q1, 13.972 in Q2, 14.016 in Q3, and 12.218 in Q4). When we decompose book value into assets and liabilities, in the second model, we find that the coefficient on assets is positive (0.913) and the coefficient on liabilities is negative (-0.915).

Next we further decompose total liabilities into the warranty liability and other liabilities and report the results under the third model. If the stock market recognizes the dual role played by the warranty liability - signaling and contingent liability - we expect the warranty liability to be valued less negatively than other liabilities (e.g., bank loans). That is, we expect to see $\beta_{13} < \beta_{12} < 0$ in support of *H1*. We find the estimated coefficient on warranty liability is negative but insignificant (coefficient is -0.442 with a t-statistic of -0.26). Consistent with H1, however, this coefficient is higher than the coefficient on other liabilities, which is negative and significant. The difference is significant at the 2% level. The result suggests that accrued warranty liabilities may also serve as a signal of future earnings growth prospects that are positively correlated with equity prices.

It is possible that the signaling role of the warranty liability offsets the expected negative relation between the warranty liability and market prices. We use model (4) to separate the signaling role of the warranty liability from that of a contingent liability. We add analysts' forecasts of growth (*ANALYST_GROWTH*) as an additional explanatory variable. If the stock market correctly values the true "liability" part of the warranty liability, we expect the warranty liability and the other liabilities to be valued similarly by the stock market after controlling for growth expectations. That is, the

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[15] In all of our regressions we base our inferences on standard errors for clustered sample (Petersen, 2007) to account for potential dependence across multiple observations of the same firm in the panel.

warranty liability reduces share prices dollar-for-dollar. In support of *H2* and *H2a*, we expect to find that $\beta_{12} = \beta_{13} = -1$. We also expect a positive coefficient on *ANALYST_GROWTH*, $\beta_{14} > 0$ if the market isolates the signaling component of the warranty liability.

The results indicate that *ANALYST_GROWTH* is positively related to equity prices (coefficient is 0.098 with a t-statistic of 2.51). Second, by including this variable, the coefficient on warranty liability becomes significantly negative and close to -1 (coefficient is -1.043 with a t-statistic of -2.72). An F-test provides support for *H2* that the coefficient on warranty liability is not significantly different from the coefficient on other liabilities (p=0.86). A second F-test provides support for *H2a* that the coefficient on warranty liability is not significantly different from –1 (p=0.98). Note that the coefficient on other liabilities is roughly the same around negative one with or without analysts' growth expectations. Overall, the results in Table 4 suggest that investors perceive the warranty liability as a strategic signal of earnings growth prospects in addition to being an estimate of a contingent liability.

5.3 Stock Market Response to Warranty Information

To further examine whether the market interprets warranty reserves as a signal for future growth prospects, we conduct a short-window event study around quarterly earnings announcements. We investigate whether investors respond to information related to warranty expenses and claims during earnings announcements. If higher than expected warranty reserves signals future growth prospects, we expect a positive relation between stock returns and abnormal warranty expenses, controlling for earnings changes, abnormal claims and other relevant information. We estimate the following model:

$$\begin{aligned} CAR_{i,t} = {} & \alpha_0 + \beta_1 ABWEXP_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 SALES\_GR_{i,t} \\ & + \beta_5 \Delta ROA_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 BM_{i.t} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

The dependent variable (CAR) is market-adjusted returns earned from one day before a quarterly earnings announcement to nine days following it (Balsam, Bartov and Marquardt, 2002).[16] The independent variables are defined as follows: abnormal warranty expenses (*ABWEXP*) and abnormal warranty claims (*ABCLAIM*) are estimated using both the time-series model and the industry model, as described in section 4. Abnormal gross margin (*ABGM*) is constructed as

$$ABGM_{j,t} = \frac{GM_{j,t} - GM_{j,t-4} * \frac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$$ under the time-series model, and

$$ABGM_{j,t} = \frac{GM_{j,t}}{SALES_{j,t}} - AVERAGE\left(\frac{GM_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$$ under the industry model. Sales growth (*SALES_GR*) is defined as the change in sales in the current quarter compared to the same quarter last year (time-series model) or over the industry average sales of other firms (industry model). ΔROA is the change in ROA calculated as the change in current reported ROA compared with the same quarter in the previous year (time-series model) or industry average ROA of other firms (industry model), where ROA is defined as earnings before extraordinary items deflated by beginning-of-quarter total assets. In the time series model, *SIZE* and *BM* are the natural logarithm of total assets and the book-to-market ratio, respectively. In the industry model, *SIZE* and *BM* are adjusted for industry averages of other firms.

The results in Table 5 indicate no significant stock price reaction to time-series-based abnormal warranty expenses and claims. However, consistent with *H3c*, investors react positively to industry-adjusted abnormal warranty expenses and claims. The coefficient on *ABWEXP* is positive

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[15] While explicit information about warranties may not be included in all firms' earnings releases, such information may be inferred from financial results, directly communicated to investors through other means, such as conference calls, and explicitly stated in forms 10-K and 10-Q. Our window extends to nine days after the earnings announcement. According to a recent survey, the median gap between an earnings announcement and the filing of financial statements with the SEC is six days (see: http://www.accountingobserver.com/default.aspx?tabid=54&EntryID=12262).

and significant (coef. = 0.802, t = 2.84). This suggests that warranty expenses above industry averages convey positive news to investors. On the other hand, investors respond negatively to abnormal warranty claims (coef. = -0.875, t = -3.10). This suggests that changes in product quality, as evidenced by increasing claims, are viewed negatively by the stock market. Consistent with prior research on earnings-response-coefficients (e.g., Ball and Brown 1968; Collins and Kothari, 1989), we find that the stock return is positively associated with earnings surprises.

5.4 Future Firm Performance and Warranty Expenses

Next, we seek to provide additional evidence on whether warranty expenses are used as a strategic tool to signal future firm performance, or as a mechanism to smooth earnings over time. To test our hypotheses 3a and 3b, we investigate the relation between current abnormal warranty expenses and two accounting-based metrics of future firm performance: (1) seasonally-adjusted sales growth in each of the next three quarters and (2) changes in ROA in each of the next three quarters. We estimate the following regression model:

$$Y_{i,t+i} = \alpha_0 + \beta_1 ABWEXP_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 SALES\_GR_{i,t} + \beta_5 \Delta ROA_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 BM_{i.t} + \varepsilon_{i,t} \quad (6)$$

where Y equals to either growth in sales in quarter $t+i$ or the change in ROA in quarter $t+i$, i=1,2,3. We define ROA as earnings before warranty expenses and extraordinary items, to avoid any mechanical relation between warranty expenses and future ROA. To ensure that our estimation is not specific to the benchmark model chosen, we perform the analysis using both time-series and industry models.

We also include claim costs, abnormal gross margin, sales growth, current change in *ROA*, size and book-to-market ratio to control for additional determinants of future sales growth and future *ROA* changes. The abnormal warranty claims is a control variable that proxies for changes in product quality. We expect a negative coefficient on this variable since higher claim costs are likely to lead to poor future firm performance. Abnormal gross margin is an additional control for product quality as

firms providing high-quality products are able to extract higher margins from their customers. We do not have any prediction on the coefficient of this variable in the sales growth model since it is not clear whether high quality firms pursue a higher sales-volume strategy. However, we do expect a positive coefficient on this variable in the future earnings model since high quality firms are generally more profitable. We expect both current sales growth and current change in ROA to be positively related to the dependent variables, because sales growth and ROA tend to persist in the short run. The coefficient on BM is expected to be negative, since it is negatively correlated with growth opportunities. Finally, we do not make any prediction on the signs of SIZE.

If managers use warranty expenses as a strategic tool to attract future sales and signal future firm profitability, we expect a positive relation between abnormal warranty expenses and future sales as well as future earnings ($\beta_1 > 0$). If, however, managers use warranty expenses to smooth earnings over time, we expect a negative relation between warranty expenses and future sales as well as future earnings ($\beta_1 < 0$). Therefore, by investigating the sign of β_1 , we are able to test *H3*a and *H3b* and find support for either a signaling or a smoothing function of the warranty expense.

Table 6 reports the results separately for the two dependent variables: future sales growth (Panel A) and future pre-warranty earnings growth (Panel B). The first, third and fifth columns of Panel A present results using the time-series based measures of abnormal warranty expenses ($ABWEXP_{\_TIME}$) and abnormal claims ($ABCLAIM_{\_TIME}$) as independent variables. We find that abnormal warranty expenses are significantly positively associated with growth in sales in the next quarter (coef. = 8.662 with a robust t = 2.39) and quarter t+2 (coef. = 8.061, t = 2.17). This positive relation is consistent with managers signaling good (bad) future performance by increasing (decreasing) their accruals for warranty expenses. This relation is not consistent with managers using warranty accruals to smooth reported earnings.

The specification in Panel A of Table 6 includes the abnormal claims made during the quarter as an explanatory variable that tracks changes in product quality. The sign on *ABCLAIM* is negative

and it is significant with respect to sales growth in quarter t+1 (coef. = -7.036, t = -2.41). This finding is consistent with the ability of changes in product quality, as reflected in abnormal claims, to predict future firm performance. We include the abnormal gross margin (*ABGM*) as an additional variable to proxy for product quality change. We do not find any evidence of a significant association between *ABGM* and future sales growth.

In the second, fourth and sixth columns of Panel A, we report results using the industry-based measures of both abnormal warranty expenses and ($ABWEXP_{\_INDUSTRY}$) and abnormal claims ($ABCLAIM_{\_INDUSTRY}$). The evidence of a positive relation between abnormal warranty expenses and future industry-adjusted sales growth is strong for all three future quarters (coef. = 2.326, t = 9.45 in quarter t+1; coef. = 5.395, t = 15.33 in quarter t+2; and coef. = 3.078, t = 4.52 in quarter t+3). The relation between abnormal industry-adjusted warranty claims is negative and significant, consistent with changes in product quality being reflected in future firm performance.

The results in Panel B of Table 6, where the dependent variable is changes in future ROA (after adding back future warranty expenses), are similar to the results reported in Panel A of Table 6. There is still a positive relation between *ABWEXP* and future firm performance in quarter t+1, as reflected in the changes in ROA (t = 2.18). However, the relation between *ABWEXP* and firm performance in quarter t+2 is weaker (t = 1.80). Regarding the relation between abnormal claims and future changes in ROA, we find a significant negative association with respect to both quarter t+1 (coef. = -0.938, t = -2.16) and quarter t+2 (coef. = -1.094, t = -2.48). The results of the industry-adjusted model in Panel B are also similar to those in Panel A of Table 6.

Based on the results documented in Table 6, we conclude that abnormal warranty expenses serve as a signaling mechanism that is employed by managers to convey their private information about future firm performance. There is a positive association between abnormal warranty expenses and future sales growth as well as future earnings changes. Furthermore, we observe that changes in warranty claims are negatively related to future firm performance, implying that changes in product quality are associated with future firm performance. The results in Table 6 are consistent with the

market reaction results reported in Table 5. Recall that investors respond positively to abnormal industry-adjusted warranty expenses. This response is consistent with the positive association of abnormal warranty expenses and future firm performance documented in Table 6. It appears that investors appreciate, at least partially, the signaling aspect of warranty expenses for future firm performance. Similarly, in Table 5 we document a negative market reaction to abnormal warranty claims. This response is consistent with the evidence in Table 6 of a negative relation between abnormal claims and future firm performance.

5.5 Benchmark Beating and Warranty Expenses

In this section, we test hypothesis 4, regarding the relation between abnormal warranty expenses and short-term incentives to meet or beat certain financial reporting benchmarks. To examine this relation we estimate the following regression model:

$$Y_{i,t} = \alpha + \beta_1 SUSPECT_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 BENCHMARK_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 MB_{i,t} + \varepsilon_{i,t} \quad (7)$$

The dependent variable, Y, is equal to the abnormal warranty expense based on either the time-series or industry model.[17] The main explanatory variable of interest is *SUSPECT*, which is an indicator variable that equals one if a firm falls in the bin to the immediate right of zero of the cross-sectional distribution of an earnings benchmark. *BENCHMARK* is the earnings benchmark managers seek to meet or beat. Following the standard practice in the literature (DeGeorge et al., 1999; Brown and Caylor, 2005), the specific benchmarks we consider are: (1) earnings from the same quarter last year. The indicator variable *SUSPECT_ΔNI* takes the value of one if the change in net income divided by total assets is between 0 and 0.0125%. (2) No loss: The indicator variable *SUSPECT_NI* takes the

[17] It is important to note that the dependent variable, abnormal warranty expenses, contain some measurement error. However, because we do not believe that there is a correlation between the measurement error and our independent variables, the reported results are not biased. Instead, our model will experience a reduction in explanatory power.

value of one if net income divided by total assets is between 0 and 0.0125% (Roychowdhury 2006), and (3) Analysts' forecasts; the indicator variable *SUSPECT_MEET* takes the value of one if a firm met or beat the last outstanding analyst consensus forecast prior to the quarterly earnings announcement by one cent or less. The other explanatory variables in the model (*CLAIM* and *GM*) are adjusted based on either the time-series or industry model, corresponding to the adjustment of the dependent variable.

Table 7 reports the results where the dependent variable is abnormal warranty expenses based on both time-series and industry models. Under the time-series specification reported in the first, third and fifth columns, we find no significant evidence of unusually high or low abnormal warranty expenses in the three samples of firms that are suspected to have managed earnings to achieve certain benchmarks. Specifically, none of the coefficients on *SUSPECT_ΔNI, SUSPECT_NI,* or *SUSPECT_MEET* is significant at conventional levels.[18]

The results are different when we use the industry-adjusted warranty expenses as a dependent variable. These results are reported in the second, fourth and sixth columns of Table 7. We find that firms reporting a small increase in net income have lower abnormal warranty expenses, as reflected in the statistically significant negative coefficient on *SUSPECT_ΔNI* of -0.213 (t = -2.17). This indicates that firms that are suspected to have engaged in opportunistic earnings management reduce warranty expenses significantly more than other firms. Further, firms reporting very low and positive levels of net income (*SUSPECT_NI*) also have low abnormal warranty expenses (coef.= -0.145, t = -2.08). We do not find significant evidence that the abnormal warranty expenses of firms that have just beat analysts' consensus forecasts are lower. The coefficient on *SUSPECT_MEET* is 0.002 with a t-statistic of 0.51.

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[18] Insignificant results may be due to errors in estimating the benchmark correctly. The warranty expenses from the same quarter in the previous year itself might have been already managed. In that case, our estimates of abnormal warranty expenses contain errors.

The results in Table 7 also show that not all of the abnormal warranty expenses are attributable to earnings management. The consistently positive coefficient on *ABCLAIM* in all three benchmark specifications (both in the time-series and in the industry-adjusted model) suggests that as the amount of claims increases, firms allocate more warranty expenses.

Overall, the results provide some evidence that warranty expenses are used as a tool for managing earnings to achieve two of the three most frequently cited benchmarks: avoiding reporting a loss and an earnings decrease. The documented evidence suggests that managers use the flexibility in assumptions underlying the warranty expense calculation and exercise their discretion to achieve their financial reporting goals.

5.6 Valuation of Warranty Liability Combining Growth Expectation and Earnings Management Incentives

Finally, we investigate the market valuation of the warranty liability by incorporating growth expectations and earnings management incentives. We seek to disentangle the three roles warranty liabilities play: a contingent liability, a strategic signal, and an earnings management tool. We examine market valuation of each component separately. To achieve this purpose, we use the following model:

$$\begin{aligned} P_{i,t} = {} & \alpha_0 + \beta_{10} ASSET_{i.t} + \beta_{12} WLIAB_{i.t} + \beta_{13} OTHER\_LIAB_{i.t} \\ & + \beta_{14} SUSPECT_{i,t} * WLIAB_{i.t} + \beta_{15} SUSPECT_{i.t} + \beta_{16} ANALYST\_GR_{i,t} * WLIAB_{i.t} \\ & + \beta_{17} ANALYST\_GR_{i,t} + \beta_2 NI_{i,t} + \beta_3 NI_{i,t} * Q_1 + \beta_4 NI_{i,t} * Q_2 + \beta_5 NI_{i,t} * Q_3 + \varepsilon_{i,t} \end{aligned} \quad (8)$$

As documented in section 5.3, firms with strong incentives to meet or beat earnings benchmarks may cut warranty expenses opportunistically. If investors correctly infer that these firms understate their warranty liabilities, they would place a larger negative coefficient on the warranty liability to correct for the underestimation.

Table 8 presents market valuation of warranty liabilities taking into account that warranty reserves are a strategic signal, a contingent liability, and an earnings management tool. As in Table 7,

we identify suspect firms that are likely to have manipulated earnings to avoid an earnings decline, avoid a loss, and meet analyst forecasts. The first column shows the results controlling for incentives to avoid an earnings decline.

In support of *H5*, we find that the stock market places a more negative coefficient on the warranty liability for firms that are suspected to have managed earnings to avoid reporting an earnings decline. The coefficient on the interaction term between *SUSPECT* and *WLIAB* is –2.858 with a t-statistic of –3.66. Similar results are found for suspect firms that seek to avoid a loss (coef. = -0.563, t =-2.70), and those that seek to meet analyst forecasts (coef. = -4.951, t =-2.90).

To test *H6*, we add analysts' earnings growth expectations (*ANALYST_GR*) as an additional explanatory variable. *ANALYST_GR* is positively associated with share price across all three models. In addition, the coefficients on warranty liability are close to negative one under all three models (-1.011, -1.073, and –0.913) for avoiding an earnings decline, avoiding a loss, and meeting analyst forecasts, respectively. This is consistent with the conjecture that investors interpret the warranty liability also as a signal of future firm performance.

We also add an interaction term between ANALYST_GR and WLIAB to examine whether the signaling ability of warranty liability varies across firms with different growth opportunities. The interaction term is positive and marginally significant, with a coefficient of 0.018 (t =1.89) for avoiding an earnings decline, 0.040 (t =1.82) for avoiding a loss, and 0.084 (t = 1.96) for meeting analyst forecast. We interpret these results as indicating that $1 of warranty liability has a stronger signaling ability for high growth firms than for low growth firms.

As a formal test of *H6*, we conduct an F-test of whether the coefficient on OTHER_LIAB is equal to the sum of the coefficient of WLIAB and its interactions with SUSPECT and ANALYST_GR, both evaluated at their median values. The results of this F-test indicate that there is no evidence to reject the hypothesis that the coefficients of WLIAB and OTHER_LIAB are the same (p-values=0.95, 0.30 and 0.27). Further, we also examine whether the coefficient on WLIAB is

different than -1, using another F-test. We cannot reject the hypothesis that WLIAB = -1 (p-values=0.93, 0.40, and 0.14).

Overall, the results in Table 8 support the conjecture that warranty reserves represent three aspects: a contingent liability, a strategic signal about growth prospects, and an earnings management tool. We find that the stock market values the warranty liability more negatively for firms that are suspects of earnings management than other firms and that it places a positive weight on warranty reserves as a signal of future growth prospects. After controlling for signaling and earnings management, we find that the stock market values the warranty liability similarly as it values other recognized liabilities.

6. Conclusion

In this paper, we study the economics and accounting aspects of product warranties. We use a sample of 600 firms which disclose warranty information from 2003 to 2006 following the requirement of FIN 45. Our paper provides insights into the market interpretation of warranty disclosures and managers' strategic choices with regards to product warranty policies as well as the accounting treatment of warranties.

We first investigate the market valuation of warranty liability. We hypothesize that warranty liabilities serve both as a strategic signal of future growth prospects and a contingent liability to perform future services related to warranty obligations. Our findings indicate that the stock market places a smaller negative valuation coefficient on the warranty liability compared to other reported liabilities. After controlling for analyst growth expectations, the valuation coefficients on both the warranty liability and other liabilities approach negative one. This supports our hypothesis that the market interprets warranty reserves also as a signal for future growth prospects. Consistent with this hypothesis, we further show that firms with higher abnormal warranty expenses exhibit higher stock returns around quarterly earnings announcements and better future firm performance.

We also examine whether managers use warranty reserves to opportunistically manage reported earnings. Specifically, we investigate whether managers use warranty accruals to meet certain earnings targets. When we define abnormal warranty expenses as the deviation from the industry mean, we find that they are associated with the two popularly cited earnings targets: (1) avoiding reporting a loss and (2) avoiding reporting an earnings decrease. Firms that are right above these two earnings targets report significantly lower warranty expenses than other firms. The evidence suggests that managers use their discretion in the estimates of warranty accruals to achieve these financial reporting targets.

In our final analysis, we investigate the market valuation of warranty reserves after controlling for strategic signaling and earnings management aspects. We show that the warranty liability reduces share price dollar-for-dollar and consequently converges to its fair market value. We also find that investors find the warranty reserves inadequate for firms that are suspects of having engaged in earnings management. Overall, the findings in this paper show that disclosures on warranties provide valuable information to market participants.

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Appendix A
Sample warranty disclosures
Middleby Corp.

In the normal course of business the company issues product warranties for specific product lines and provides for the estimated future warranty cost in the period in which the sale is recorded. The estimate of warranty cost is based on contract terms and historical warranty loss experience that is periodically adjusted for recent actual experience. Because warranty estimates are forecasts that are based on the best available information, claims costs may differ from amounts provided. Adjustments to initial obligations for warranties are made as changes in the obligations become reasonably estimable. A rollforward of the warranty reserve is as follows:

	2005	2004
Beginning balance	10,563	11,563
Warranty expense	8,916	8,417
Warranty claims	(8,193)	(9,417)
Ending balance	11,286	10,563

10Q for the period ended 9/02/05

3M
Note 11 WARRANTY AND OTHER GARANTEES

Products are sold with varying lengths of warranty ranging from 90 days to the lifetime of the products. Allowances for estimated warranty costs are recorded in the period of sale, based on historical experience related to product failure rates and actual warranty costs incurred during the applicable warranty period. Also, on an ongoing basis, we assess the adequacy of our allowances related to warranty obligations recorded in previous periods and may adjust the balances to reflect actual experience or changes in future expectations.

The following Table summarizes the activity in the allowance for estimated warranty costs for the first quarters of fiscal 2006 and fiscal 2005 (in thousands):

	Three Months Ended August 31,	
	2005	**2004**
Accrued warranty, beginning of period	$41,782	$43,825
Cost of warranty claims processed during the period	(7,919)	(9,124)
Provision for warranties related to products sold during the period	6,865	7,896
Accrued warranty, end of period	$40,728	$42,597

In prior years, we entered into several agreements whereby we sold products to resellers who, in turn, sold the products to others, and we guaranteed the payments of the end users. However, since deferred revenue and other associated accruals related to such sales approximate the guaranteed amounts, any payments resulting from end user defaults would not have a material impact on our results of operations.

10Q for the period ended 9/02/05

Table 1 Sample Composition

	Firm-quarters	**Firms**
Original file	14,510	889
Subtract: Observations without valid COMPUSTAT GVKEY information	(516)	(36)
Subtract: Observations without direct information on warranty expenses and claims.	(4,473)	(47)
	9,521	**806**
Subtract: Observations without valid discretionary warranty expense information	(3,278)	(110)
Subtract: Observations without valid other variable information	(1,722)	(96)
	4,521	**600**

Table 2 Sample Composition by Industry

SIC Code (2 digits)	Industry	N	N (%)	WEXP/SALES (%)	CLAIM/SALES (%)
15	General Building Contractors	21	3.50	0.750	0.617
16	Heavy Construction, Except Building	1	0.17	1.205	0.714
22	Textile Mill Products	2	0.33	1.090	1.149
24	Lumber & Wood Products	6	1.00	3.468	3.625
25	Furniture & Fixtures	14	2.33	0.612	0.597
26	Paper & Allied Products	1	0.17	0.065	0.053
28	Chemical & Allied Products	15	2.50	2.593	2.154
29	Petroleum & Coal Products	1	0.17	0.838	0.854
30	Rubber & Miscellaneous Plastics Products	9	1.50	1.079	1.109
33	Primary Metal Industries	4	0.67	0.492	0.498
34	Fabricated Metal Products	12	2.00	0.754	0.759
35	Industrial Machinery & Equipment	150	25.00	1.815	2.223
36	Electronic & Other Electric Equipment	146	24.33	1.449	1.397
37	Transportation Equipment	49	8.17	1.172	1.142
38	Instruments & Related Products	130	21.67	1.550	1.426
39	Miscellaneous Manufacturing Industries	8	1.33	1.177	1.012
48	Communications	1	0.17	0.000	4.227
50	Wholesale Trade- Durable Goods	5	0.83	0.389	0.459
55	Automotive Dealers & Service Stations	3	0.50	0.722	0.703
63	Insurance	1	0.17	0.153	0.093
73	Business Services	13	2.17	0.850	0.863
75	Auto Repair, Services, & Parking	1	0.17	3.394	4.009
87	Engineering & Management Services	3	0.50	1.461	1.706
99	Non classifiable Establishments	4	0.67	0.705	1.714

Table 3 Summary Statistics

	N	MEAN	STD	Q1	MEDIAN	Q3
General variables--S&P 500 firms (from 2003 to 2006)						
MARKET CAPITALIZATION ($MILLION)	7,926	21,594	38,272	5,202	10,129	19,695
SALES ($MILLION)	7,943	3,837	7,159	763	1,775	3,771
TOTAL ASSETS ($MILLION)	7,925	44,754	136,019	4,111	11,368	28,870
BM	7,792	0.424	0.269	0.244	0.375	0.553
ROA	7,848	0.015	0.023	0.004	0.013	0.024
General variables—Warranty sample firms (from 2003 to 2006)						
MARKET CAPITALIZATION ($MILLION)	4,521	3,227	9,790	208	678	2,151
SALES ($MILLION)	4,521	639	1,807	34	112	464
TOTAL ASSETS ($MILLION)	4,521	2,620	8,091	137	488	1,844
BOOK-TO-MARKET	4,521	0.466	0.268	0.274	0.417	0.603
ROA	4,517	0.008	0.053	0.001	0.013	0.025
ROA BEFORE WEXP	4,517	0.012	0.053	0.004	0.017	0.029
Warranty-related variables						
WEXP ($MILLION)	4,521	8.541	37.927	0.252	1.155	4.770
WEXP/SALES (%)	4,521	1.377	1.336	0.479	0.962	1.863
WEXP/TOTAL ASSETS (%)	4,521	0.376	0.443	0.107	0.236	0.476
WEXP/OPINCOME (%)	4,288	10.973	152.679	1.648	5.903	14.329
WEXP/ ABS(NI) (%)	4,519	54.836	306.856	5.224	13.142	32.545
WEXP/ TOTAL_EXP (%)	4,247	1.478	1.438	0.494	1.024	2.048
$ABWEXP_{time}$ (%)	4,006	-0.016	0.305	-0.092	-0.005	0.066
$ABWEXP_{industry}$ (%)	4,521	-0.088	1.320	-0.968	-0.394	0.411
WLIAB/ LIAB (%)	4,512	4.144	4.267	1.429	2.824	5.447
Claims-related variables						
CLAIM ($MILLION)	4,521	7.349	32.984	0.249	1.145	4.233
CLAIM /SALES (%)	4,521	1.274	1.296	0.415	0.868	1.675
CLAIM /TOTAL ASSETS (%)	4,521	0.358	0.440	0.098	0.219	0.441
CLAIM / OPINCOME (%)	4,288	9.034	169.092	1.685	5.217	13.458
$ABCLAIM_{time}$ (%)	4,031	-0.031	0.270	-0.094	-0.009	0.056
$ABCLAIM_{industry}$ (%)	4,521	-0.108	1.353	-0.975	-0.414	0.321

Table 3 Continued

Notes:

MARKET CAPITALIZATION is defined as quarterly closing price multiplied by number of common shares outstanding, SALES is quarterly sales revenue, TOTAL ASSETS is total assets measured at the end of fiscal quarter, BM is book-to-market ratio defined as book value of equity /market value of equity, ROA is defined as income before extraordinary $items_t$ /Total $Assets_{t-1}$, ROA before WEXP is defined as (income before extraordinary $items_t$ + warranty expense)/Total $Assets_{t-1}$,WEXP is warranty expense, CLAIM is claim costs, OPINCOME is operating income before depreciation, ABS(NI) is absolute value of net income where net income is defined as income before extraordinary items, LIAB is total liability, and WLIAB is warranty liability. ABWEXP is abnormal warranty expense based on either the time-series model or the industry model. ABCLAIM is abnormal claims based on either the time-series model or the industry model. All variables are calculated at the end of each fiscal quarter.

Table 4 Market Valuation of Warranty Liability

	Dependent Variable = $PRICE_t$							
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
BV_t	1.173	17.62						
$ASSET_t$			0.913	11.06	0.917	9.73	0.914	10.93
$LIAB_t$			-0.915	-7.08				
$WLIAB_t$					-0.442	-0.26	-1.043	-2.72
$OTHER\_LIAB_t$					-0.865	-7.75	-0.883	-6.43
NI_t	12.218	11.59	12.404	11.55	13.367	11.76	12.295	11.33
NI_Q1_t	3.010	6.15	3.296	5.72	2.190	3.61	3.406	5.51
NI_Q2_t	1.754	5.32	1.835	6.55	1.482	4.86	1.894	6.12
NI_Q3_t	1.798	4.95	2.072	6.88	1.755	5.43	2.176	6.58
$ANALYST\_GR_t$							0.098	2.51
Test of $WLIAB_t = OTHER\_LIAB_t$					F = 5.62	p = 0.02	F = 0.03	p = 0.86
Test of $WLIAB_t = -1$					F = 9.77	p = 0.00	F = 0.00	p = 0.98
Adj R^2	0.858		0.858		0.866		0.878	
N	5,868		5,868		5,868		5.868	

Notes: The above table shows the market valuation of warranty liability. The dependent variable is price per share. Coefficients on industry (2-digit SIC code) and quarterly dummies are not shown. $ANALYST\_GR_t$ is analyst long-term earnings growth forecasts as reported in I/B/E/S. Q1, Q2, Q3 are indicators for fiscal quarter 1, 2, and 3, respectively. All the independent variables except $ANALYST\_GR_t$ are deflated by common shares outstanding. The robustness t-statistic is based on standard errors that are robust to cross-sectional dependence.

Table 5 Market Return and Abnormal Warranty Expense

	Dependent variable = CAR (-1, +9)			
	Time-series model		Industry model	
	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic
INTERCEPT	0.262	0.14	-2.418	-1.39
$ABWEXP_t$	-0.922	-0.72	0.802	2.84
$ABCLAIM_t$	-0.491	-0.35	-0.875	-3.10
$ABGM_t$	0.908	3.58	0.005	0.86
$SALES\_GR_t$	0.014	1.05	0.007	0.88
ΔROA_t	0.407	3.58	0.501	6.22
$SIZE_t$	-4.579	-2.79	0.114	1.02
BM_t	0.211	1.48	2.144	2.80
Adj R2	4.9%		2.9%	
N	2,431		3,915	

Notes: CAR (-1, +9) is defined as market-adjusted returns cumulated from one day before to nine days after quarterly earnings announcement. ABWEXP is abnormal warranty expenses, ABCLAIM is abnormal claims, ABGM is abnormal gross-margin, SALES_GR is sales growth relative to the same quarter of the preceding year, ΔROA is defined as the difference between current quarter ROA and ROA of the same quarter in the preceding year, SIZE is defined as the logarithm of total assets, BM is book-to-market ratio. ΔROA, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentage. In the industry model, all variables are measured as the deviation from the industry average of other firms where the industry is defined at the 2-digit SIC level. The robustness t-statistic is based on standard errors that are robust to cross-sectional dependence. Coefficients on industry and quarterly dummies are not shown.

Table 6 Future Performance and Abnormal Warranty Expense

Panel A Future Sales Growth and Abnormal Warranty Expense

	Dependent Variables					
	SALES GR $_{t+1}$		SALES GR $_{t+2}$		SALES GR $_{t+3}$	
	Time-series model	Industry model	Time-series model	Industry model	Time-series model	Industry model
	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)
INTERCEPT	9.999 (1.84)	70.004 (73.81)	20.202 (2.62)	94.425 (49.93)	30.525 (2.99)	126.239 (46.95)
ABWEXP $_t$	8.662 (2.39)	2.326 (9.45)	8.061 (2.17)	5.395 (15.33)	0.269 (0.07)	3.078 (4.52)
ABCLAIM $_t$	-7.036 (-2.41)	-4.286 (-10.69)	-5.083 (-1.26)	-5.262 (-9.37)	2.106 (0.39)	-3.230 (-4.20)
ABGM $_t$	-0.291 (-0.49)	-0.016 (-1.52)	-0.234 (-0.27)	-0.000 (-0.16)	-0.246 (-0.26)	-0.005 (-1.18)
SALES_GR $_t$	0.620 (10.29)	0.481 (77.13)	0.425 (7.99)	0.128 (22.14)	0.277 (3.45)	-0.047 (-3.50)
ΔROA $_t$	0.679 (1.31)	-0.633 (-1.32)	0.684 (1.24)	-0.428 (-1.61)	-0.499 (-0.63)	-0.781 (-1.46)
SIZE$_t$	-0.555 (-1.34)	0.014 (5.55)	-1.468 (-2.25)	0.018 (0.78)	-2.244 (-2.32)	-0.314 (-2.19)
BM $_t$	-5.568 (-2.28)	-0.229 (-2.72)	-7.183 (-1.93)	-0.380 (-2.08)	-7.908 (-1.74)	-1.673 (-1.56)
Adj R^2	41.9%	75.6%	19.0%	55.9%	6.3%	56.9%
N	4,154	6,133	3,695	5,636	3,201	5,174

Table 6 Continued

Panel B Pre-Warranty Future Earnings and Abnormal Warranty Expense

	Dependent Variables					
	ΔROA_{t+1}		ΔROA_{t+2}		ΔROA_{t+3}	
	Time-series model	Industry model	Time-series model	Industry model	Time-series model	Industry model
	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)
INTERCEPT	0.041 (0.06)	-0.744 (-1.43)	0.304 (0.47)	-0.980 (-1.45)	-0.298 (-0.33)	-2.380 (-2.87)
$ABWEXP_t$	0.734 (2.18)	0.372 (2.62)	0.701 (1.80)	0.189 (1.86)	0.195 (1.05)	0.182 (1.29)
$ABCLAIM_t$	-0.938 (-2.16)	-0.290 (-1.91)	-1.094 (-2.48)	-0.083 (-0.74)	-0.324 (-1.63)	-0.365 (-3.26)
$ABGM_t$	0.327 (5.09)	0.002 (1.01)	0.128 (1.84)	0.003 (1.95)	-0.028 (-1.08)	0.003 (3.18)
$SALES\_GR_t$	0.017 (4.75)	0.013 (5.08)	0.009 (2.07)	0.009 (2.56)	0.002 (0.33)	-0.001 (-1.32)
ΔROA_t	0.231 (5.73)	0.628 (16.27)	0.132 (3.16)	0.541 (10.66)	0.051 (0.77)	0.338 (7.20)
$STD(OI/SALES)_t$	-0.862 (-0.86)		-0.947 (-0.87)		0.219 (0.16)	
$SIZE_t$	-0.002 (-0.04)	0.239 (4.40)	-0.009 (-0.18)	0.280 (3.98)	0.051 (0.67)	0.477 (4.60)
BM_t	-1.271 (-2.68)	-1.685 (-4.77)	-0.702 (-1.97)	-1.692 (-3.94)	-0.280 (-0.64)	-1.683 (-3.67)
Adj R^2	12.0%	34.7%	5.5%	24.5%	2.9%	20.0%
N	3,974	4,494	3,476	4,029	2,556	3,791

Notes: ROA is defined as earnings before extraordinary items and warranty expenses deflated by beginning –of-year total assets. ΔROA, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentage. In the industry model, all variables are measured as the deviation from the industry average of other firms where the industry is defined as the 2-digit SIC level. The robustness t-statistic is based on standard errors that are robust to cross-sectional dependence. Coefficients on industry and quarterly dummies are not shown.

Table 7 Incentives, Earnings Management and Warranty Expenses

	Dependent Variables = $ABWEXP_t$					
	Avoid earnings decline		Avoid loss		Meet analyst forecast	
	Time-series model	Industry model	Time-series model	Industry model	Time-series model	Industry model
	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)	Coefficient (Robustness t-statistic)
INTERCEPT	0.046 (1.81)	0.012 (0.42)	-0.021 (-1.15)	0.002 (0.10)	-0.062 (-2.71)	1.615 (18.82)
$SUSPECT\_\Delta NI_t$	0.014 (1.20)	-0.213 (-2.17)				
$SUSPECT\_NI_t$			0.013 (0.57)	-0.145 (-2.08)		
$SUSPECT\_MEET_t$					-0.000 (-0.03)	0.002 (0.51)
$ABCLAIM_t$	0.591 (13.34)	0.519 (5.22)	0.560 (12.39)	0.602 (6.35)	0.601 (15.61)	0.464 (32.98)
$ABGM_t$	-0.574 (-1.95)	-0.236 (-2.55)	-1.228 (-1.39)	-0.034 (-3.40)	-0.953 (-3.01)	-0.788 (-8.36)
ΔNI_t	0.041 (0.26)	1.579 (2.29)				
NI_t			0.377 (0.89)	-5.027 (-1.19)		
EPS_t					0.002 (0.34)	-1.351 (-3.92)
$SIZE_t$	0.000 (0.19)	0.009 (0.68)	0.004 (1.74)	0.047 (1.33)	0.006 (2.43)	-0.059 (-5.00)
MB_t	-0.003 (-1.64)	0.001 (0.47)	-0.007 (-1.58)	0.000 (0.47)	-0.004 (-2.01)	0.043 (1.95)
Adj R^2	24.1%	42.1%	20.8%	40.3%	33.1%	93.0%
N	4,915	5,575	5,349	6,063	3,729	4,852

Table 7 Continued

Notes:
SUSPECT_ΔNI takes the value of one if the change in net income divided by total assets is between 0 and 0.0125%. *SUSPECT_NI* takes the value of one if net income divided by total assets is between 0 and 0.0125%. *SUSPECT_MEET* takes the value of one if a firm met or beat the last outstanding analyst consensus forecast prior to the quarterly earnings announcement by one cent or less. SIZE is the logarithm of the market value of equity at the beginning of the quarter. NI is earnings before extraordinary items scaled by lagged total assets. ΔROA, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentages. In the industry model, all variables are measured as the deviation from the industry average of other firms where the industry is defined as the 2-digit SIC level. The robustness t-statistic is based on standard errors that are robust to cross-sectional dependence. Coefficients on industry and quarterly dummies are not shown.

Table 8 Valuation of Warranty Liability Incorporating Growth and Earnings Management

	Dependent Variable = $PRICE_t$					
	Avoid earnings decline		Avoid loss		Meet analyst forecast	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
$ASSET_t$	0.812	9.96	0.919	11.03	0.710	7.30
$WLIAB_t$	-1.011	-3.05	-1.073	-2.76	-0.913	-2.50
$OTHER\_LIAB_t$	-0.730	-7.05	-0.786	-6.47	-0.701	-5.79
$SUSPECT_t * WLIAB_t$	-2.858	-3.66	-0.563	-2.70	-4.951	-2.90
$SUSPECT_t$	4.289	4.16	-6.004	-6.59	2.602	4.11
$ANALYST\_GR_t * WLIAB_t$	0.018	1.89	0.040	1.82	0.084	1.96
$ANALYST\_GR_t$	0.066	2.57	0.090	2.25	0.101	2.21
NI_t	13.291	11.89	12.082	11.32	16.619	8.05
NI_Qtr1_t	3.121	3.70	3.302	5.55	4.435	4.22
NI_Qtr2_t	1.971	5.00	1.790	5.76	3.312	4.55
NI_Qtr3_t	1.219	2.48	2.120	6.55	3.318	4.14
Test of $WLIAB_t$ * [1+ Median (SUSPECT) + Median ($ANALYST\_GR_t$)] = $OTHER\_LIAB_t$						
	F = 0.00	p = 0.95	F = 1.07	p = 0.30	F = 1.23	p = 0.27
Test of $WLIAB_t$ * [1+ Median (SUSPECT) + Median ($ANALYST\_GR_t$)] = -1						
	F = 0.01	p = 0.93	F = 0.72	p = 0.40	F = 2.15	p = 0.14
Adj R^2	0.876		0.900		0.894	
N	4,781		4,854		4,513	

Notes: The above table shows market valuation of warranty liability after incorporating earnings management incentives. The dependent variable is price per share. Coefficients on industry (2-digit SIC code) and quarterly dummies are not shown. $ANALYST\_GR_t$ is analyst long-term earnings growth forecasts as reported in I/B/E/S. Q1, Q2, Q3 are indicators for fiscal quarter 1, 2, and 3, respectively. SUSPECT is defined as $SUSPECT\_\Delta NI$ in the "avoid earnings decline" regression, SUSPECT_NI in the "avoid loss" regression, and SUSPECT_MEET in the "meet analyst forecast" regression. All the independent variables except $SUSPECT_t$ and $ANALYST\_GR_t$ are deflated by common shares outstanding. The robustness t-statistic is based on standard errors that are robust to cross-sectional dependence.